Disentangling the Impact of Securitization on Bank Profitability

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Abstract

We empirically evaluate the channels through which securitization impacts bank profitability. To this end, we analyze the role played by bank risk, cost of funding, liquidity and regulatory capital in explaining the relationship between securitization and bank profitability. We find that securitization activities tend to boost profitability. We also show that bank risk, cost of funding, liquidity and regulatory capital individually and jointly act as transmission channels in the securitization-profitability relationship. In addition, we break down the securitization effects on bank profitability into direct and indirect effects and identify the contribution of each individual transmission channel in the overall impact on bank profitability. Our findings have several implications for banks, financial markets, and regulators.

Keywords: Securitization, Bank Profitability, Bank Risk, Regulatory Capital, Liquidity, Cost of Funding.
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1 Introduction

Securitization has fundamentally altered the way in which financial intermediation is organized as it has provided banks with various incentives to improve efficiency and performance. The bank may aim to improve its cost of funding (Pennacchi, 1988), to improve its risk management (Cebenoyan and Strahan, 2004), or to improve its profitability (Affinito and Tagliaferri, 2010). Although theory suggests that securitization benefits both issuing banks and investors, empirical evidence does not uniformly support these theoretical conclusions. In addition, securitization was blamed for being a primary cause of the 2008 US mortgage crisis where it acted as the vehicle for the increase in lower-quality subprime debt.

In the aftermath of the 2008 credit crisis, securitization markets became subject to intensive regulatory reforms which implied the curbing of certain higher risk activities. These reforms led to significant impairment in securitization markets as shown by the large decline in securitization issuance in both the US and Europe (Association for Financial Markets in Europe, 2017). This impairment has contributed to the decline in bank's revenues from capital market-related activities –including securitization– compared to commercial banking activities. It has also contributed to keeping the post-crisis bank profitability subdued (Bank for International Settlements, 2018). Nevertheless, there have been several attempts to revive securitization markets to boost banking efficiency and risk sharing in capital markets (Mersch, 2017). These attempts require a deep revision of the securitization effects on both banks and financial markets to avoid any unintended consequences for bank performance and stability.

In this paper, we empirically evaluate the impact of securitization on bank profitability. Our main contribution is to analyze the channels through which securitization impacts bank profitability. In so doing, we argue that the impact of securitization on bank profitability is transmitted through four main channels, namely bank risk, cost of funding, liquidity and regulatory capital. That is, securitization affects these four variables which in turn affect bank profitability. To test this argument, we break the relationship between securitization and bank profitability down into four individual intermediate relationships, then test them empirically. This allows us to individually and simultaneously assess the role of these proposed channels in shaping the relationship between securitization and bank profitability.

This paper contributes to the strand of literature that studies the impact of securitization on bank profitability. In particular, our paper is closely related to Loutskina and Strahan (2009) who consider the impact of securitization on bank liquidity and Loutskina (2011) who considers the impact on cost of funding. We add to these studies by integrating both channels of securitization effects and further investigating their simultaneous impact on bank profitability. In addition, our paper is closely related to Casu et al. (2013) who study the effects of securitization on bank performance. However, our paper differs in that we aim to disentangle the impact of securitization on bank profitability instead of just limiting the focus to whether there is an association between securitization and bank profitability. Unlike Casu et al. (2013), we consider four different transmission channels for the impact of securitization on bank profitability. Therefore, the main contribution of our paper to the existing literature on bank profitability is providing an answer for the question: *"How does securitization affect bank profitability?"* instead of asking whether there is an impact.

We use a novel empirical model that thoroughly investigates how securitization affects bank profitability while considering the causality between different variables. Also, our empirical framework is based on a Structural Equations Modeling (SEM) approach that can simultaneously test the different relationships comprised in the proposed empirical model. This approach allows us to break down the securitization effects on bank profitability into direct and indirect effects. It also allows us to identify the contribution of each individual channel in the overall impact on bank profitability.

Our findings provide insights into the complex relationship between securitization and profitability. There is evidence that securitization activities increase the bank risk due to the credit enhancements and the recourse associated with securitization transactions. Also, securitization is found to increase the cost of funding which can be attributed to the increase in the explicit and implicit costs resulting from recourse. The results also suggest that securitization enables banks to reduce their holdings of liquid assets given the availability of the option to securitize. Regulatory capital increases as a percentage of total assets when banks securitize their high-quality loans while keeping the worst loans.

In addition, we show that bank risk and cost of funding have positive impact on bank profitability. This occurs when banks accept to take more risk, but seek to achieve more income from servicing and trading activities. In addition, results indicate that while higher holdings of liquid assets are associated with lower bank profitability, higher regulatory capital is associated with higher profitability as it secures the bank against risk and failure.

We also show the mechanism in which securitization contributes to improving bank profitability. We use a novel empirical model that provides an accurate and thorough representation of the relationship between securitization and bank profitability. Our results show that bank risk, cost of funding, liquidity and regulatory capital work as transmission channels in the securitization-profitability relationship. Considering these four channels together provides an additional explanatory power regarding how securitization affects bank profitability. In addition, our findings shed light on situations in which the total effect of the securitization on bank profitability is not significant while the direct and indirect effects are significant, but with opposite signs.

Our findings have several implications. First, the ability to divide the effects of securitization between different components of the securitization-profitability relationship enables the bank to control this relationship. In other words, the bank can alter its decisions regarding which loans to securitize, what type of enhancements and recourse to provide, and the timing of transactions. These decisions together would improve the design of securitization transactions. Second, investors in financial market would improve their assessment of the change in perceived risk of a bank due to a securitization transaction. The investors would then be able to adjust their required rates of return on the bank equity capital based on the new risk expectations, which implies a fair share price. Finally, our findings might help regulators in imposing regulations that ensure a fair and transparent securitization market.

The remainder of this paper is divided as follows. Section 2 provides institutional background. Sections 3 provides an overview of related literature and develops the research hypotheses. Section 4 provides an overview of the methodological framework and data. Section 5 presents the empirical results. Section 6 concludes the paper.

2 Developments in the US Banking Industry and Securitization Market

The US banking industry has experienced an enormous transformation over the course of the last few decades. One of these transformations was a trend of increase in the portion of industry income generated from fees-based activities (such as securitization) rather than interest-generating activities starting from the 1980s. This trend has fundamentally altered the risk-return profiles of US banks over the last few decades (DeYoung and Roland, 2001). Particularly, banks costs of production were static or declining and there has been an increase in total revenues from traditional and non-traditional sources. This meant that by the mid-2000s, US banks profitability was very strong (Carlson and Weinbach 2007). Indeed, until mid-2007 it was widely perceived that the US banking system was sound and performing well, particularly because banks capital holdings and profitability appeared to be high and at record levels. Nevertheless, Clark et al. (2007) emphasize how the increasingly fee-focused strategies of large US banks expose these banks to economic and business cycle volatility. With the onset of the mortgage crisis, problems in the housing market spelled over to the banking industry. The increased number of foreclosures and defaults in mortgages led to a decline in the value of securitized assets and reduced investors' appetite for such securities and accordingly problems within the US banking industry (Gerardi et al., 2008).

In the US, securitization origins go back to the early 1970s, when Government National Mortgage Association (Ginnie Mae) started to sell mortgage loans (Ibanez and Scheicher, 2012). Then, In the 1980s, the market grew with the issuances of securities by the semi-governmental agencies, Federal Home Loan Mortgage Corporation (Freddie Mac) and the Federal National Mortgage Association (Fannie Mae). Initially, securitization processes included mortgage loans forming what is known as Mortgage Backed Securities (MBS). Later, they expanded to include other types of loans forming what is known as Asset Backed Securities (ABS). Furthermore, in the run up to the 2008 credit crisis, more sophisticated forms of securitization were developed such as Collateralized Mortgage Obligations (CMO). Securitization activities played a pivotal role for the housing market in the run up to the credit crisis of 2008 as the Asset Backed Securities (ABS) and covered bonds provided between 20 and 60 per cent of the funding for new residential mortgage loans originated in mature economies (IMF, 2009).

Historically, the MBS activities have denominated the securitization market. The total volume of outstanding MBS in the US increased from $347 million in 1970 to nearly $8.92 trillion at the

end of 2016, while the ABS market moved from $1.2 billion in 1985 to nearly $1.33 trillion at the end of 2016 (SIFMA, 2016). Also, it is worth noting that the outstanding securitization amounts reached a peak of $11 trillion at the end of 2007, exactly before the strike of the credit crisis of 2008. In addition, the growth in securitization activities was rapid in the run up to the global financial crisis, but contracted sharply since the strike of the financial crisis in 2008 as shown by the large declines in the securitizations issuances. For example, Securitization issuance, including agency and non-agency mortgage-backed securities (MBS) and asset-backed securities (ABS), totalled $2.2 trillion in 2016 which is equivalent to around two-thirds of the pre-crisis annual rate, and mainly driven by the agency MBS (SIFMA, 2016).

3 Literature Review and Hypotheses Development

This paper is closely related to the strand of literature that studies the impact of securitization on bank profitability. In theory, securitization enables banks to convert illiquid assets quickly into cash and to remove liabilities associated with these assets from their balance sheets. The cash proceeds from securitization can be used in different ways. For example, it can be used to replace existing funding sources such as deposits, consequently, reducing interest expense accrued for these deposits, and leading to higher reported earnings (Ibanez and Scheicher, 2012). Additionally, banks can use these proceeds to grant new loans that can be securitized later, thus repeating the same process and creating an asset-securitization pipeline structure (Wolfe, 2000). This structure allows banks to receive fee income for servicing the securitized loans, and to improve their return on equity (ROE) effectively because the new income can be supported by a smaller equity base. Moreover, proceeds from securitizations can be reinvested in loans directed to new profitable projects, thus aligning the average rate of the bank's loan portfolio with the market rate and increasing the bank's income from interest (Thomas, 1999).

This paper also contributes to the empirical literature on the effect of securitization on bank profitability. For example, Greenbaum and Thakor (1987) use an asymmetric information model which suggests that securitization allows banks to specialize in activities of comparative advantage while shifting the activities of comparative disadvantage. Moreover, Boot and Thakor (1993) show that in the presence of asymmetric information, securitization of assets enables the issuer to increase its expected revenue. Hansel and Bannier (2008) study the drivers of

securitization in the US banking system and show that banks use loan securitization to access capital-market based businesses, thus, engage in riskier activities which provide them with fee income and improve their expected returns. Moreover, Jiangli and Pritsker (2008) use data on the US bank holding companies (BHC) to explore what would happen had the mortgage securitizers taken their securitized mortgages back on their balance sheet. Their findings suggest a very positive impact on bank profitability for mortgage securitization, but not for non-mortgage securitization. Furthermore, Casu et al. (2013) apply a propensity score matching approach to investigate the US banks performance. They compare between securitizers and non-securitizers based on different performance indicators. They show that profitability is significantly and positively affected by securitization.

The mechanism of securitization activities implies that it has implications for bank performance. We argue that securitization affects a set of bank-specific intermediate variables which, in turn, affect bank profitability. These factors include bank risk, cost of funding, liquidity and regulatory capital. In the subsections below, we develop the necessary hypotheses to test this argument.

3.1 Bank Risk Channel

Securitization's effect on bank risk is twofold (Instefjord, 2005). On the one hand, it may reduce bank risk by shifting credit risk to the market and improving risk sharing opportunities. In support of this view, Cebenoyan and Strahan (2004) argue that aggressive use of securitization encourages banks to take more risk; however, the new risk is still outweighed by the credit risk initially transferred to investors. Jiangli and Pritsker (2008) show that securitization reduces insolvency risk. They provide evidence that, during the 2007-2009 credit crisis, mortgage credit and securitization markets disorders were due to excess supply in those markets. Affinito and Tagliaferri (2010) show that banks tend to keep high-quality loans while securitizing their worst loans. Similarly, Mian and Sufi (2009) show that in the run up to the credit crisis, US banks managed to securitize their worst mortgage loans, thus reducing credit risk.

On the other hand, securitization may increase bank risk due to the increase in risk taking and recourse or other seller-provided credit enhancements (Higgins and Mason, 2004). Ambrose et al. (2005) suggest a positive effect of securitization on bank credit risk due to retaining riskier loans while selling safer ones in response to regulatory requirements. Calomiris and Mason

(2004) and Casu et al. (2011) show that high amounts of outstanding securitizations reduced US banks risk appetite prior to the financial crisis. They attribute this to the recourse hypothesis implying an already high credit risk. Moreover, Bedendo and Bruno (2012) provide evidence that US banks intensively used securitization to obtain funds, in times of frozen liquidity markets during the financial crises, at the expense of higher overall bank risk. Similar evidence is provided for European banks in Uhde and Michalak (2010) and for Italian banks in Battaglia and Gallo (2013).

Bank risk is by far a major factor that affects profitability. The predominant type of bank risk is credit risk which materializes when a loan becomes irrecoverable, or a borrower fails to meet the loan servicing costs in time. Empirical studies report negative effects of credit risk on profitability (Bourke, 1989; Miller and Noulas, 1997). This is because higher credit risk implies higher loan loss provisions, and accordingly lower returns recognized by banks. Moreover, Athanasoglou et al. (2008) report that excess exposure to credit risk reduces profitability. Nevertheless, Tan (2016) show that the impact of risk on bank profitability is insignificant especially when considering the impact of banking industry competition. Thus, based on the preceding discussion we can formulate our first hypothesis as:

H1: Bank risk works as a transmission channel between securitization and bank profitability

3.2 Cost of Funding Channel

Securitization provides banks with an opportunity to diversify their sources of funding by providing them with a new source represented in their holdings of loans. Early studies suggest that securitization offers lower cost of financing (Pennacchi, 1988). Jones (2000) finds that banks securitize, among other reasons, to diversify funding sources, reduce the costs of external financing through debt and deposits, and accordingly to reduce the overall cost of funding. Loutskina (2011) argues that the availability of securitization as an internal source of funds reduces the sensitivity of the bank cost of funding to the availability of other external sources of funds such as traditional liquid funds and deposits. This implies that securitization could reduce shocks to cost of funding.

In contrast, some studies provide evidence that securitizers tend to have a higher cost of funding compared to other banks. Higgins and Mason (2004) argue that, in the short term, the potential

benefits to banks in terms of reduced cost of funding might be outweighed by the implicit and explicit costs resulting from recourse related to the transaction. Similarly, Casu et al. (2013) provide evidence from US BHC that securitization initially provides banks with a cheaper source of funds. However, the perceived increase in credit risk forces banks to offer higher credit risk enhancements to accompany issued securitizations that ultimately increase the cost of that funding source.

Furthermore, cost of funding is another important factor that impacts bank profitability. The sources from which a bank can raise funds vary between deposits, debt, equity capital, or asset sales where each source has its unique cost. Demirguc-Kunt and Huizinga, (1999) show that relying mainly on deposits as a funding source is less profitable as compared to other sources because taking deposits from customers requires a network of branches, thus incurring other expenses of branching. Similarly, Kupiec and Lee (2012) argue that the use of brokered deposits is significantly associated with lower bank ROA, and that the higher the cost of funding the lower the bank profitability. Meanwhile, other sources of funding are less costly, such as in the case of debt and assets sale, or more secure, such as in the case of equity. This is consistent with previous studies (e.g., Berger, 1995; Demirguc-Kunt and Huizinga, 1999; Kosmidou et al., 2007) which support the argument that banks with lower need for external funds, have lower cost of bankruptcy and lower cost of funding and thus higher profitability. Thus, based on the preceding discussion we can formulate the second hypothesis as:

H2: Cost of funding works as a transmission channel between securitization and bank profitability

3.3 Liquidity Channel

The traditional incentives of securitization entail increasing liquidity as a primary objective because securitization allows banks to liquidate illiquid assets (Cardone-Riportella et al., 2010). The main argument in this regard is that securitization increases bank liquidity which is then directed to profitable investments (Lockwood et al., 1996; Krahnen and Wilde, 2006). However, this view ignores the role of securitization in managing liquidity risk, while emphasizing the increase in bank liquidity based on traditional measures of liquidity.

Moreover, Affinito and Tagliaferri (2010) show that securitization is used by banks to improve liquidity positions and to mitigate liquidity risk exposures. This view is also supported by Loutskina and Strahan (2009) who find that banks with large amounts of liquid holdings are more likely to grant loans that are difficult to securitize than to grant liquid loans. In other words, banks consider securitization as another source of liquidity that is not counted in the traditional liquidity measures. Furthermore, Loutskina (2011) proposes an index of the liquidity of a bank's loan portfolio, which measures the securitize-ability of bank loans. She concludes that when banks have the option to securitize, they reduce their holdings of liquid assets. She argues that banks will have the chance to convert illiquid assets into liquid ones upon need, thus they do not have to hold large amounts of liquid assets.

Liquidity is another factor that impacts bank profitability. Banks may decide to hold liquid assets to reduce risks and to avoid bank failures (Imbierowicz and Rauch, 2014). However, liquid assets are usually associated with lower rates of return. While Bourke (1989) and Pasiouras and Kosmidou (2007) shows a significantly positive relationship between liquidity and bank profitability, Guru et al (2002) and Molyneux and Thornton (1992) report an opposite result. Similarly, Chronopoulos et al. (2016) provide evidence of the negative impact of liquidity on profitability of US banks. Nevertheless, Kosmidou et al. (2007) provide mixed evidence about that effect using data of Greek banks. Therefore, the impact of liquidity on bank profitability remains an unsettled debate. Thus, based on the preceding discussion, we can formulate the third hypothesis as:

H3: Liquidity works as a transmission channel between securitization and bank profitability

3.4 Regulatory Capital Channel

The regulatory capital arbitrage implies that banks securitize assets with relatively lower risk than those assets retained in their portfolio. Similarly, reputation hypothesis predicts that banks securitize their best loans while retaining bad ones. Both hypotheses predict that banks may use securitization to minimize regulatory capital requirements (Ambrose et al., 2005). For instance, Calem and LaCour-Little (2004) argue that, for most mortgage loans, regulatory capital levels are too high, which motivates banks to securitize the least risky loans. Also, Passmore et al.

(2002) show that the motivation to securitize loans declines, as regulatory capital requirements increase.

Furthermore, Affinito and Tagliaferri (2010) show that banks mainly engage in securitization to reduce risk, improve liquidity, and improve capital ratios. Moreover, those banks manage to achieve these goals in the years immediately after their first securitization transaction. Finally, Ambrose et al. (2005) analyze the effects of securitization on risk-based capital ratios and leverage ratios and show that regulatory incentives have a substantial impact on shaping retention and capital decisions.

Additionally, capital plays a pivotal role in determining bank profitability and is widely argued to have a positive impact on profitability. On the one hand, managers in banks may raise capital ratios to signal future expected improvements in performance (Myers and Majluf, 1984). On the other hand, banks may decide to have an adequate level of capital to face any potential risks, which reduces the probability and thus the costs of bankruptcy (Berger, 1995). In either case, capital is expected to have a positive impact on profitability which is supported by other empirical studies as well (see Bourke 1989; Berger, 1995; Demirguc-Kunt and Huizinga, 1999; Pasiouras and Kosmidou, 2007). However, some studies document negative impact of regulatory capital on bank profitability. For example, Tran et al. (2016) show that regulatory capital negatively granger-causes profitability after controlling for bank characteristics, market risk, and macroeconomic conditions. They argue that higher capital requirements may lower bank profitability through higher cost of capital and lower tax shield savings. Thus, based on the preceding discussion, we can formulate the fourth hypothesis as:

H4: Capital works as a transmission channel between securitization and bank profitability

3.5 Simultaneous Impact

The preceding discussion shows that securitization is found to affect bank risk, cost of funding, liquidity, and regulatory capital, even though, the sign of this effect is not conclusive. Meanwhile, those factors affected by securitization are also determinants of bank profitability. We should also expect that the impacts of securitization and intermediate variables are simultaneous. Therefore, it can be argued that securitization transfers its effects to profitability

simultaneously through a set of intermediate variables including bank risk, cost of funding, liquidity and regulatory capital. Thus, we can formulate our fifth hypothesis as:

H5: Bank risk, cost of funding, liquidity and regulatory capital jointly work as transmission channels between securitization and bank profitability

The proposed framework is illustrated in **Figure 1** where each arrow represents an individual relationship between two variables. The model is constructed to capture both direct and indirect effects of securitization on bank profitability. For example, the arrow labelled γ_0 represents the direct impact of securitization on profitability, whereas the indirect effect that is mediated by bank risk is represented by the product of γ_1 and β_1. The same logic applies to cost of funding, liquidity and regulatory capital as proposed transmission channels. Thus, the total effect is the sum of both direct effect (γ_0) and indirect effects ($\gamma_1 \bullet \beta_1$, $\gamma_2 \bullet \beta_2$, $\gamma_3 \bullet \beta_3$, and $\gamma_4 \bullet \beta_4$).

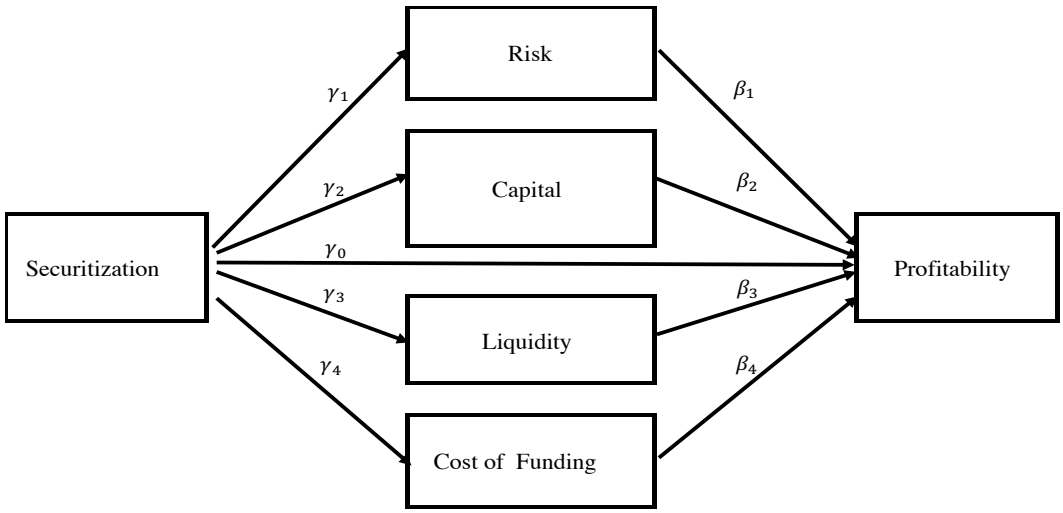

Figure 1: The impact of securitization on bank profitability and the four transmission channels: bank risk, cost of funding, liquidity and regulatory capital

4 Methodology and Data

This section describes the econometric specification, provides an overview of research variables, describes the data sample, and provides summary statistics.

4.1 Econometric Specification

The main hypothesis that we test is that bank risk, cost of funding, liquidity and regulatory

capital work as transmission channels between securitization and bank profitability. To this end, we implement a *mediation analysis* in which each channel would be viewed as a *mediator* (Cheong and MacKinnon, 2012). We start by investigating whether there is any potential effect resulting from the bank engagement in securitization activities on its profitability. Then we outline our model of testing and evaluating mediation effects in the securitization-profitability relationship.

4.1.1 Does Securitization Affect Bank Profitability?

To empirically investigate the relationship between securitization and bank profitability of banks that engage in securitization activities, we estimate the following bank-specific fixed effects panel data model:

$$PROF_{i,t} = \alpha_i + \gamma\ SEC_{i,t-1} + \lambda\ Controls_{i,t-1} + \varepsilon_{i,t} \qquad (1)$$

where $PROF_{i,t}$ denotes bank profitability, $SEC_{i,t-1}$ denotes securitization, t represents time, α is a constant, $Controls_{t-1}$ denotes a set of control variables, and ε is an error term. γ is the coefficient of interest. We estimate the model with clustered standard errors at the bank level, which enables us to use within-bank variations to estimate the parameters of the relationship between securitization and profitability. The outstanding amount of securitization is used as the main explanatory variable for explaining the variation in bank profitability. In addition, some variables are included to control for the bank-specific characteristics, including loans to assets ratio, capital ratio, bank size, real GDP growth, trading assets ratio, loans to deposits, market share, and deposits to assets ratio. Variables are described in detail in section 4.2 below.

4.1.2 Identifying Individual Transmission Channels

The direct relation between securitization and profitability can be expressed as follows:

$$PROF_{i,t} = \alpha_i + \gamma_0\ SEC_{i,t-1} + \varepsilon_{i,t} \qquad (2)$$

Starting from a no mediation status is necessary to construct significance tests and to assess to what extent the direct effect of the independent variable is impaired by introducing a mediator into the relationship (Baron and Kenny, 1986).

Next, we introduce mediators into the securitization-profitability relationship. The following equation represents the relationship between a given mediator and securitization as the independent variable:

$$MED_{i,t} = \alpha_i + \gamma_1 \, SEC_{i,t-1} + \varepsilon_{i,t} \quad (3)$$

where $MED_{i,t}$ represents any one of the four mediators involved: bank risk, cost of funding, liquidity or regulatory capital.

Finally, we account for both direct and indirect effects of securitization on bank profitability after introducing the mediator as follows:

$$PROF_{i,t} = \alpha_i + \gamma_0 \, SEC_{i,t-1} + \beta_1 \, MED_{i,t-1} + \varepsilon_{i,t} \quad (4)$$

We then use a Structural Equations Modeling (SEM) approach to estimate Eqs. 3 and 4 simultaneously. Thus, these equations can be rewritten in the following general notation:

$$Y = \Gamma \, X + B \, Y + \Psi \quad (5)$$

where Y is a 2 x 1 vector that represents the endogenous variables: the mediator used and the bank profitability. X is a 1 x 1 vector representing the exogenous variable: securitization, while Γ is a 2 x 1 vector representing the relation between securitization as an independent variable and each one of the mediator and bank profitability as dependent variables. Moreover, B is a 2 x 2 matrix that represents the relation between the mediator and bank profitability. Finally, Ψ is a 2 x 1 vector that represents the error terms of the endogenous variables. More details on how we derive the structural model specified in Eq. (5) can be found in Appendix A.

Using SEM to fit our mediation model to data has several advantages. First, SEM fits the model equations to data simultaneously, combining all the linear equations into one, using matrices and vectors (Cheong and MacKinnon, 2012). This simultaneous estimation of the model parameters enables us to control for and partial out other relationships that might influence the impact of securitization on bank profitability and lessens the need for controlling variables (Iacobucci, 2008). Second, bootstrap procedures based on Maximum Likelihood (ML) estimation method can be applied to estimate the coefficients in a SEM, which provides more reliable and unbiased estimations for the indirect effect and enables us to infer more accurately about mediation (Cheong and MacKinnon, 2012). Third, SEM approaches are superior to regression-based approaches for testing mediation. Compared with regression-based approach, SEM is capable of handling complicated models that incorporate multiple mediators or those that use variables measured by multiple indicators (Cheong and MacKinnon, 2012). Furthermore, in a comparison study by Iacobucci et al., (2007), simulations show that SEM is superior to regressions in testing

mediation. Finally, SEM makes use of a measurement model and a structural model; the former to enhance the reliability of the measured constructs, and the latter to examine the possibility of meditational interrelationships among the constructs.

Therefore, we employ a SEM technique to estimate Eq. (5). Additionally, to conclude the presence of mediation, the z-test is used to test the significance of the indirect path as proposed by Sobel (1982) and recommended by Iacobucci (2008). In addition, we use bootstrap techniques to generate confidence intervals for the indirect effects to test for significance as outlined by Zhao et al. (2010) who show that to establish mediation, the focus should be on the indirect effect path meaning that the direct path should not necessarily be significant to conclude mediation.

4.1.3 Identifying Simultaneous Transmission Channels

The next step in testing the hypothesized mediation model is to construct and test a model that incorporates all the four proposed mediators at the same time. The aim here is to assess the direct and indirect effects of securitization on bank profitability in a more dynamic way that mimics the reality of this relationship. In addition, the complete mediation model helps to divide the indirect effect between mediators and estimate the percentage contribution of each one in transferring the effect from securitization to bank profitability (Iacobucci, 2008).

Following the same logic used to arrive at Eq. (5), the four-mediator model can be expressed by the following equation:

$$\eta = \Gamma\, \xi + B\, \eta + \Psi \qquad (6)$$

Where η is a 5 x 1 vector that represents the endogenous variables: the four mediators used and the bank profitability. Also, ξ is a 1 x 1 vector representing the only exogenous variable used: securitization, while Γ is a 5 X 1 vector representing the relation between securitization as an independent variable and each one of the mediators and bank profitability as dependent variables. Moreover, B is a 5 x 5 matrix that represents the relation between mediators and bank profitability. Finally, Ψ is a 5 x 1 vector that represents the error terms of the endogenous variables. More details on how we derive the structural model specified in Eq. (6) can be found in Appendix A.

As in the single-mediator models above, we employ a SEM technique to estimate Eq. (6). In addition, we use the z-test as proposed by Sobel (1982) to test the significance of the indirect paths. Also, we use bootstrap techniques to generate confidence intervals for the indirect effects to establish and classify mediation and to test for significance as outlined by Zhao et al. (2010).

4.1.4 Significance of Transmission Channels

The key to infer a mediated relationship between securitization and bank profitability through any of the previous proposed models is to test the significance of the indirect effects. Iacobucci (2008) argues that it is necessary for a mediation to be established that both the path X→M and the path M→Y paths (represented by arrows (γ) and (β), respectively, on **Figure 1**) be significant. If this is the case, one can move further to test the significance of the indirect path represented by the product (γ · β). The null hypothesis in this test is that the indirect effect is equal to zero. There are two methods to construct and test this hypothesis: z-test and bootstrap procedures.

Sobel (1982) proposes z-test that compares the size of the direct path before including the mediator as in Eq. (2) and the size of the same path after controlling for the indirect mediated effect as in Eq. (4) (Iacobucci, 2008). In other words, z-test tests whether the mediated path (γ · β) is statistically different from zero. This test statistic can be expressed as follows:

$$z = \frac{\gamma \cdot \beta}{\sqrt{\beta^2 \sigma_\gamma^2 + \gamma^2 \sigma_\beta^2}} \qquad (7)$$

Sobel's z-test assumes normality for the product of the indirect path coefficients (γ · β) and the z values. This renders the test biased towards not rejecting the null hypothesis more often and consequently concluding no mediation. Therefore, bootstrapping techniques can be used to overcome this issue of the z-test (Zhao et al., 2010). It is argued that the bootstrap test of indirect effects will always be more powerful than Sobel's test (MacKinnon et al., 2004; Shrout and Bolger, 2002). The proposed bootstrap test relies on the actual distribution of the indirect path coefficients (γ · β) to construct confidence intervals for the indirect effect (Cheong and MacKinnon, 2012). The estimated indirect effect is statistically significant if the confidence intervals do not include the value of 0.

4.1.5 Contribution of Transmission Channels

The final step in analyzing the theoretical mediation model is computing the percentage contribution of each mediator in explaining the variation in bank profitability. This step is important to fully understand and visualize the complex relationship between securitization and bank profitability as represented in the four-mediator model. In this regard, we follow the method applied by Iacobucci (2008) to estimate the percentage of indirect effect using the estimated indirect and direct path coefficients as follows:

$$k_m = \frac{\gamma_{mx} \cdot \beta_{ym}}{(\gamma_{mx} \cdot \beta_{ym}) + \gamma_0} \qquad (8)$$

where k_m is the indirect effect that is transmitted through mediator m as a percentage of total effect. This equation can also be extended to account for all the mediators in the four-mediator model as follows:

$$K = \frac{\Sigma_m \gamma_{mx} \cdot \beta_{ym}}{(\Sigma_m \gamma_{mx} \cdot \beta_{ym}) + \gamma_0} \qquad (9)$$

where K is the total indirect effect that is transmitted through all mediators as a percentage of total effect. The parameters estimates needed to calculate k_m and K are extracted from the model estimates as we show in the results below. For more details on deriving the indirect effects as in Eqs. (8) and (9), please refer to Appendix A.

4.2 Variables

Dependent Variable. The main dependent variable in our paper is bank profitability. Following previous research, bank profitability is measured by either return on assets (ROA) or net interest margin (NIM) (Berger et al., 1995). ROA is a basic measure of bank profitability that corrects for the bank size. It measures how efficiently banks' assets are being used to generate profits. Another useful measure of bank profitability is net interest margin (NIM) which is estimated as the difference between interest income and interest expenses scaled by total assets. This measure focuses on the profitability of the loan portfolio of the bank, hence, it might be reasonable to use it as a measure of profitability given our focus on securitization activities of banks.

Mediators. We use four variables as mediators. We use two measures for bank risk including the ratio of risk-weighted assets to total assets (RWATA) following Berger and Bouwman (2013), and the ratio of charge-offs to total loans (CHRGOFS) following Casu et al. (2013). These

measures capture the riskiness of the bank loan portfolio that backs its securitization activates providing a proxy for risk-taking behaviour of securitizer banks. To measure the on-balance sheet liquidity of the bank, a widely-used measure is core liquidity ratio (CORELIQ) which is estimated as the ratio of cash to total assets, and the liquidity ratio (LIQ) which is estimated as the ratio of cash and securities to total assets. In addition, following Berger and Bouwman (2013), we use two measures for regulatory capital including tier 1 leverage ratio (TIER1LEV), and tier1 risk based capital ratio (TIER1RBC). Finally, we use two measures for cost of funding including interest expense to total liabilities (INTTLIB) and interest expense to total deposits (INTTDEP).

Exogenous Variables. The key explanatory variable is securitization (SEC), measured as the bank's outstanding balance of securitized assets as a percentage of total assets (SECTASTS) or as a percentage of total loans (SECTLNS). These measures are lagged one period to allow the effects of securitization activities to be realized in bank profitability. Securitization is expected to liquidate current loans and provide the bank with an opportunity to grant new loans based on the new higher rates, in addition it provides other revenues arising from servicing fees (Casu et al., 2013). Thus, the association between a bank's outstanding securitization and its profitability is expected to be positive.

Control Variables. Some balance sheet ratios are included in our model specifications to control for the bank-specific characteristics that may affect profitability. First, bank size (SIZE) measured by the natural logarithm of total assets is used. The bank size is expected to positively affect its profitability due to the economies of scale or the ability of large banks to lend more. Also, it is expected that large banks benefit more from securitization as they have better access to the securitization market due to their large and homogenous loans portfolio (Loutskina, 2011). Another measure that captures the influence of a bank is market share (MRKTSH) which is estimated as the ratio of a bank's total assets to the sum of total assets of all banks (Berger and Bouwman (2013). We also use a few control variables to account for the balance sheet heterogeneity among banks. We include the loan to assets ratio (LNSTASTS) which reflects the relative importance of the bank's loan portfolio. Loans are expected to generate the highest rates compared to other asset categories which implies that the higher the loans to assets ratio, the higher the bank profitability. We also use the ratio of trading assets to total assets (TRDASTS) which captures the impact of market factors on the bank trading portfolio and overall

profitability. We also include the loans to deposits ratio (LNSTDEP) and the deposits total assets ratio (DEPTASTS) to account for the stability of bank funding. The lower the LNSTDEP ratio and the higher the DEPTASTS ratio, the more stable are the bank funding sources. In addition, we include capitalization (CAP) in our specifications. It is measured as the percentage of total equity capital to total assets. Maintaining high capital levels would provide the bank with protection in case of a banking crisis, and against different risks resulting from the bank exposure to outstanding securitizations. Moreover, the protection provided by capital buffer would support the bank profitability in the long run (Pasiouras and Kosmidou, 2007). The relationship between capital and profitability is then expected to be positive. Finally, to control for the macroeconomic determinants of bank profitability, we use the change in Gross Domestic Product (GDPG). It is expected that changes in GDP would capture the effects of the business cycle on bank profitability as outlined by Demirguc-Kunt and Huizinga (1999). It is thus expected that changes in GDP have a positive impact on bank profitability. A summary of the definitions and calculation methods for all variables used in our analysis is provided in Appendix B.

4.3 Data

In this subsection, we describe the data sample, and provide summary statistics.

4.3.1 Data Sample

We use data on US commercial banks including balance sheet information and securitization activities. We use this specific dataset mainly due to the dominant role of the US banks in the securitization markets, the size of the US banking sector, and more importantly data availability. We obtain the data from the Federal Financial Institutions Examination Council (FFIEC) database in the form of Reports of Condition and Income (Call Reports) on a quarterly basis. The data are available as a complete balance sheet, income statement, and detailed supporting schedules for each reporting bank. Call Reports include a separate schedule for off-balance sheet items (RC-S) which contains data on securitization activities. Reporting banks are required to submit this detailed information on their securitization activities starting from the second quarter of 2001. In addition, given the structural changes in the securitization market following the global financial crisis, we use a balanced window centred around the crisis period of 2007-2009 to avoid any bias in results due to the impact of impaired securitization markets following the

financial crisis. Thus, our dataset covers 52 quarters starting from the second quarter of 2001 to the first quarter of 2014.

Our data sample includes only securitizers. This includes all banks that have an outstanding balance of securitizations for at least two quarters over the sample period. This is necessitated by our proposed empirical model of the effects of securitization on bank profitability, which requires data on securitizers only. Furthermore, banks with missing information on total assets, liquidity, loans, deposits, capital, and income are excluded from the sample. In addition, we obtain data on macroeconomic variables form the Federal Reserve Economic Data (FRED) database. To prevent the possibility of outliers driving the results, quarterly variables computed from the dataset are winsorized at the 1% level, that is, the smallest and largest 1% of the values of each variable are replaced with the closest value. The final dataset consists of 4842 bank-quarters observations for 595 commercial banks. We provide summary statistics on this dataset below.

4.3.2 Summary Statistics

Table 1 provides summary statistics for the variables used to test the mediation model. Panel A provides statistics on profitability measures, which indicates a higher disturbance in the ROE compared with the ROA or NIM. The three measures show that bank profitability can be negative sometimes, but can rise sharply in other times. This is in line with the fact that securitizers have additional sources of income from securitization activities such as servicing fees and trading revenue.

Moreover, panel B provides statistics on cost of funding measures that shows higher disturbance in interest expense to total deposits ratio compared to interest expense to total liabilities ratio (standard deviation of 2.310 and 0.010 respectively). This results from the high variation in the level of deposits as shown by a standard deviation of 0.172 in the deposits to assets ratio. Turning to the regulatory capital measures, panel C shows that they are generally consistent with each other. Moreover, it shows that, on average, securitizers tend to keep capital more than required by regulatory authorities (10%, and 15% as compared to 5%, and 8% requirements for Tier1 leverage ratio, and Tier1 risk-based capital ratio, respectively). This may be explained by the recourse hypothesis which implies that securitizers continue to be liable for the loans

securitized and provide credit enhancements for them. With respect to bank risk measures, panel D shows that risk-weighted assets to total assets ratio has a high standard deviation of 0.270 compared to 0.021 of the charge-offs ratio.

Table 1: Summary Statistics

This table provides summary statistics of variables used in the analysis. All ratios are expressed in decimal points. Size is calculated as ln(Total Assets). GDPG is measured as the percentage change from previous quarter. Detailed description of variables is provided in Table B.1.

	N	Mean	Std. Dev.	Min	Max
Panel A: Bank Profitability					
Return on assets	4842	0.007	0.018	-0.296	0.236
Net interest margin	4842	0.024	0.017	-0.029	0.206
Panel B: Cost of funding					
Interest expense to total liabilities	4842	0.013	0.010	0.000	0.062
Interest expense to total deposits	4842	0.150	2.310	0.000	85.431
Panel C: Regulatory Capital					
Tier1 leverage ratio	4842	0.103	0.060	-0.051	0.704
Tier1 risk based capital ratio	4842	0.150	0.060	-0.081	1.340
Panel D: Bank Risk					
Risk-weighted assets to total assets	4842	0.738	0.270	0.000	5.771
Charge-offs ratio	4842	0.008	0.021	0.000	0.375
Panel E: Liquidity					
Core liquidity ratio	4842	0.060	0.061	0.000	0.748
Liquidity ratio	4842	0.249	0.138	0.001	0.836
Panel F: Securitization					
Securitization to total assets	4842	0.278	1.084	0.000	40.371
Securitization to total loans	4842	0.728	7.500	0.000	448.966
Panel G: Control Variables					
Size	4842	13.465	1.888	9.647	18.910
Trading assets to total assets ratio	4842	0.003	0.023	0.000	0.706
Loans to total assets ratio	4842	0.661	0.155	0.026	1.030
Loans to deposits ratio	4842	3.633	1.425	0.082	5.855
Deposits to total assets ratio	4842	0.757	0.172	0.000	0.996
Capital ratio	4842	0.110	0.061	-0.065	0.729
Market share	4842	0.000	0.001	0.000	0.008
GDP real growth	4842	1.694	2.589	-8.200	6.900

Additionally, panel E provides statistics on liquidity measures that show relatively moderate to low liquidity ratios. This is common with securitizers that follow an originate-to-sell securitization model. Measures of securitization activities are shown in panel F which shows that securitizers are active in this market as they hold outstanding balances of securitizations that represent about 28% of assets and 73% of loans on average. Finally, panel G provides statistics on control variables measures. It shows a relatively small trading assets ratio. Also, securitizers maintain a relatively high loans/assets and deposits/assets ratios of 66% and 76%, respectively. Moreover, they tend to hold a relatively small amount of equity capital, 11% on average, which might reflect the fact that they have access to funds through the securitization market.

In sum, the previous discussion of summary statistics suggests that securitizers hold riskier loans measured by the high risk-weighted assets to total assets ratio. Additionally, they have relatively high capital ratios and relatively low liquidity ratios as they are supported by the high liquidity provided by their ability to access the securitization market.

5 Results and Discussion

This section presents the results of testing the empirical mediation model as specified in the methodology section above. The mediation models are estimated using SEM based on the Maximum Likelihood estimation method and a bootstrap procedure with 2000 iterations to construct a 95% confidence interval for the coefficients, direct, indirect, and total effects. We also provide a set of additional robustness checks.

5.1 Impact of Securitization on Bank Profitability

Table 2 reports the results of our initial regression analysis. The regression is well specified as evidenced by the absence of serial correlation or multicollinearity. It is also significant as shown by Wald (χ^2) ($p < 0.01$). The model explains nearly 28% of the variation in bank profitability as measured by ROA. The coefficient on SECTASTS is significantly positive, which indicates a significant positive relationship between the engagement in securitization activities and the bank profitability. This is consistent with our previous predictions about the direction of this relationship as documented in **Table B.1** and its magnitude as shown by the significantly positive linear correlation between securitization and bank profitability. The same findings are

supported in previous research. For example, in their study of the impact of securitization on bank performance, Casu et al. (2013) use a Propensity Score Matching (PSM) technique based on different dimensions of bank performance including profitability. Although the overall analysis did not support an impact of securitization on bank performance, the profitability dimension was found to be significantly affected by securitization activities. Similarly, Jiangli and Pritsker (2008), Lockwood et al. (1996) and Thomas (1999) suggest a positive impact of securitization on profitability using data on US commercial banks and bank holding companies.

Based on the findings from the regression in **Table 2**, we can move further to analyzing the channels through which securitization transfer its impact to bank profitability.

Table 2: Results of Analysing the Impact of Securitization on Bank Profitability.

This table provides the results of analysing the impact of securitization on bank profitability based on the fixed effects regression specified as: $PROF_{i,t} = \alpha_i + \beta 1\ SEC_{i,t-1} + \gamma 1\ Controls_{i,t-1} + \varepsilon_{i,t}$. Bank Profitability is measured by ROA. Securitization is measured as the ratio of securitization to total assets (SECTASTS). Other control variables include loans to assets ratio (LNSTASTS), capital ratio (CAP), bank size (SIZE), real GDP growth (GDPG), trading assets ratio (TRDASTS), loans to deposits (LNSTDEP), market share(MRKTSH), and deposits to assets ratio (DEPTASTS). Standard errors are clustered by bank. Detailed description of variables is provided in Table B.1.

Variable	Coefficients	Robust Std. Errors
Constant	-.002	.0041
SECTASTS	.061***	.0016
LNSTASTS	.008**	.0039
CAP	.084***	.0229
SIZE	.091*	.0516
GDPG	.046***	.0000
TRDASTS	-.002	.0055
LNSTDEP	.043*	.0232
MRKTSH	.029	.0531
DEPTASTS	-.008*	.0047
Model Fit		
Wald (χ^2)	843.40	
Prob. (χ^2)	.000	
Adj. R^2	.281	
Bank Fixed Effects	Yes	
Observations	4842	

5.2 Results of Individual Transmission Channels

Having established the basic relationship between securitization and bank profitability, we can now move further to investigate the role that proposed mediators play in this relationship. In doing so, bank risk, cost of funding, liquidity and regulatory capital are used as mediators by turn. We use SEM based on Maximum Likelihood to estimate Eq. (5). Meanwhile, to assess the

significance of mediation a bootstrap procedure is utilized to generate confidence intervals for the coefficients obtained. In addition, Sobel's z-test is calculated for each mediator. The results of these individual models are presented in **Table 3.**

First, bank risk measured by risk weighted assets to total assets (RWATA) is used as a mediator. From **Table 3**, the model seems to adequately fit data in this case as Chi-square (χ^2) equals 1.122 (χ^2 / df = 1.122, p = 0.290), the adjusted goodness of fit (AGFI) equals 0.999, and the root mean square error of approximation (RMSEA) of 0.005 (Bentler and Bonett, 1980). The analysis shows that all the paths are significantly positive as the confidence interval for each of them does not include the value zero. This is in line with findings in previous literature. For example, Bedendo and Bruno (2012) provide evidence that securitization activities have been mainly used over the past decade to increase bank's ROA at the expense of higher overall bank risk. Moreover, Nijskens and Wagner (2011) argue that credit transfer activities in US commercial banks increased their systematic risk.

Turning to the mediating role of bank risk, the analysis shows that both indirect and direct effects are significant ($p < 0.01$ for both), additionally the Sobel test is significant ($z = 13.369$, $p < 0.01$). Moreover, the product of the direct and indirect effects is positive. Applying the criteria of Zhao et al. (2010), one can conclude the existence of complementary mediation. In other words, the bank risk significantly mediates the relationship between securitization and bank profitability. The mediation percentage can be estimated as 21% (0.070/0.327). Classifying mediation as complementary and having this low mediation percentage suggests the possibility of other omitted mediators.

Next, the cost of funding measured by interest expense to total liabilities (INTTLIB) is used as a mediator. Based on the criteria of Bentler and Bonett (1980), the results from **Table 3** show that the model seems to fit the data reasonably well where Chi-square (χ^2) equals 2.228 (χ^2/df = 2.228, p = 0.136), the AGFI equals 0.998, and the RMSEA equals 0.016. The analysis shows that all the paths are significantly positive as the confidence interval for each of them does not include the value zero. The positive effect of securitization on the cost of funding is explained by the increase in the implicit and explicit costs resulting from recourse as shown in the above model that uses bank risk as a mediator. The same results are shown in previous research (e.g.

Higgins and Mason (2004) and Casu et al. (2013)). Moreover, the positive effect of cost of funding on profitability is challenged by previous studies as in Kupiec and Lee (2012). However, this may be due to banks increasing income from servicing and securitization related activities while their cost of funding increases.

With respect to the mediating role of cost of funding, the analysis shows that both indirect and direct effects are significant ($p < 0.05$ and $p < 0.01$ respectively), additionally the Sobel test is significant ($z = 3.395$, $p < 0.01$). Moreover, the product of the direct and indirect effects is positive. Following the criteria of Zhao et al. (2010), these results show that the cost of funding significantly mediates the relationship between securitization and bank profitability. The mediation can be classified as complementary mediation with an estimated mediation percentage of 15% (0.05/0.326).

Furthermore, when using liquidity measured by cash and securities to total assets ratio (LIQ) as a mediator, **Table 3** shows similar results to those of the above models. Following the same criteria used above, the model seems to fit the data reasonably well where Chi-square (χ^2) equals 4.045 (χ^2/df = 4.045, $p = 0.063$), the AGFI equals 0.943, and the RMSEA equals 0.071. However, the analysis shows that while the path from securitization to profitability (liquidity) is positive (negative), the path from liquidity to profitability is negative. The negative coefficient of the path from securitization to liquidity shows that banks use securitization as a liquidity management tool. They tend to reduce their holdings of liquid assets as long as they have the "option to securitize" available to use in the short term. The same findings are supported by Loutskina and Strahan (2009) and Loutskina (2011). Similarly, the negative coefficient of the path from liquidity to profitability implies that the higher the bank holdings of liquid assets, the lower its profitability because liquid assets are associated with low returns. The same finding is shown by Bourke (1989) and Pasiouras and Kosmidou (2007).

Regarding the mediation role of liquidity, the analysis shows that both indirect and direct effects are significant ($p < 0.10$ and $p < 0.01$ respectively), additionally the Sobel test is significant ($z = 3.023$, $p < 0.01$). Moreover, the product of the direct and indirect effects is positive. Based on the criteria of Zhao et al. (2010), it can be concluded that liquidity significantly mediates the

relationship between securitization and bank profitability with a percentage of 2% (0.005/0.331). The mediation can be classified as complementary.

Finally, **Table 3** also shows the results of using regulatory capital measured by Tier1 leverage ratio (TIER1LEV) as a mediator. The results are similar to those of the above models, and the model seems to fit the data reasonably well where Chi-square (χ^2) equals 1.071 (χ^2/df = 1.071, p = 0.301), the AGFI equals 0.999, and the RMSEA equals 0.004 (Bentler and Bonett, 1980). The analysis shows that both the paths from securitization and from regulatory capital to profitability are significantly positive as the confidence interval for each of them does not include the value zero, while the path from securitization to profitability is not significant (p > 0.10). The positive path between securitization and regulatory capital implies that securitizer banks end to hold higher capital than required by regulation. This may be explained by the tendency of banks to securitize their best loans while keeping low-quality loans, thus, their current holdings of capital would increase as a percentage of assets as they securitize more. The same findings are found in Affinito and Tagliaferri (2010). Similarly, the same findings of the positive path from regulatory capital to profitability are supported in previous research (see Bourke 1989; Berger, 1995; Demirguc-Kunt and Huizinga, 1999; Pasiouras and Kosmidou, 2007). The main argument here is that banks keep high capital ratios to exploit available investments and to reduce risk exposures, thus increasing profitability.

Regarding the mediation role of regulatory capital, while indirect effect is significant (p<0.01), the direct effect is not (p>0.10). Additionally, the Sobel test is significant (z = 30.048, p < 0.01). Based on the criteria of Zhao et al. (2010), the results show the absence of any direct effect and a complete mediation can be concluded. In other words, when using regulatory capital as a mediator the only effect that securitization has on bank profitability is indirect through regulatory capital. The mediation percentage can be estimated as 92% (0.306/0.333).

The results of the individual mediation models provide evidence that bank risk, cost of funding, liquidity, and regulatory capital have mediating effects on the relationship between securitization and bank profitability. Except for the direct path in the regulatory capital model, all the individual relationships in these four models are shown to be significant. However, they do not completely conform with previous literature with respect to the sign of the effect. For example,

Table 3: Results of Analysing the Individual Transmission Channels

This table provides the results of analysing the four transmission channels that mediate the relationship between securitization and bank profitability. We use SEM based on Maximum Likelihood estimation method to estimate the mediation model specified in Eq. (5) as: $Y = \Gamma X + B Y + \Psi$. Bank Profitability is measured by ROA. Securitization is measured as the ratio of securitization to total assets (SECTASTS). LIQ refers to liquidity ratio and is used as a measure of bank liquidity. RWATA refers to the ratio of risk-weighted assets to total assets and is used as a measure of bank risk. INTTLIB is the ratio of interest expense to total liabilities and is used as a measure of the cost of funding. TIER1LEV is the tier 1 leverage ratio and is used as a measure of regulatory capital. Detailed description of variables is provided in Table B.1. We report standardized coefficients along with their 95% confidence intervals and *p* values as estimated by a bootstrap procedure based on 2000 iterations. To assess significance, ***: significant at p<0.01, **: significant at p<0.05, *: significant at p<0.10.

Panel A: Paths Coefficients	**Bank Risk**			**Cost of funding**			**Liquidity**			**Regulatory Capital**		
Path	Standardized Coefficients	Confidence Interval Lower	Upper	Standardized Coefficients	Confidence Interval Lower	Upper	Standardized Coefficients	Confidence Interval Lower	Upper	Standardized Coefficients	Confidence Interval Lower	Upper
SECTASTS → ROA	.257***	.137	.532	.321***	.172	.602	.325***	.179	.606	.027	-.050	.222
SECTASTS → RWATA	.291***	.132	.594									
RWATA → ROA	.242***	.131	.321									
SECTASTS → INTTLIB				.087***	.055	.144						
INTTLIB → ROA				.056**	.002	.110						
SECTASTS → LIQ							-.058*	-.202	-.016			
LIQ → ROA							-.092***	-.128	-.044			
SECTASTS → TIER1LEV										.543***	.388	.782
TIER1LEV → ROA										.563***	.490	.634
Panel B: Division of Effect												
Total Effect	.327***	.177	.609	.326***	.176	.608	.331***	.179	.614	.333***	.180	.617
Direct Effect	.257***	.137	.532	.321***	.172	.602	.325***	.179	.606	.027	-.050	.222
Indirect Effect	.070***	.038	.109	.005**	.000	.011	.005*	.000	.011	.306***	.212	.432
Panel C: Model Fit												
Chi-square (χ^2)	1.122			2.228			4.045			1.071		
df (χ^2)	1			1			1			1		
Prob. (χ^2)	.290			.136			.063			.301		
χ^2 / df	1.122			2.228			4.045			1.071		
AGFI	. 999			.998			.943			.999		
RMSEA	. 005			.016			.071			.004		
Sobel Test	13.369***			3.395***			3.023***			30.048***		
R^2 (Bank Profitability)	.160			0.11			.118			.235		
R^2 (Mediator)	.085			0.01			.003			.195		
Observations	4842			4842			4842			4842		

while bank risk and cost of funding are found to positively affect profitability, previous studies suggest a negative effect for both. This contradiction can be justified in two ways. First, banks may intensively engage in securitization activities applying a generate-to-sell model and accepting to take more risk (see for example Bedendo and Bruno, 2012; Nijskens and Wagner, 2011), but increase their income from non-interest income in the form of servicing fees (Casu et al., 2013) or trading activities (Minton et al., 2009). Thus, any increase in bank risk or cost of funding due to securitization is accompanied by an increase in profitability and accordingly a positive relationship can be justified on this basis. Second, most of the studies that claim a negative impact of bank risk (e.g. Bourke, 1989; Miller and Noulas, 1997; Athanasoglou et al., 2008) and cost of funding (e.g. Berger, 1995; Demirguc-Kunt and Huizinga, 1999; Kosmidou et al., 2007) on profitability use data on periods that precede the credit crisis of 2008. While our paper utilizes a more recent dataset and accordingly captures the changes in the securitization market that followed the credit crisis.

5.3 Results of Simultaneous Impact of Transmission Channels

The individual mediation models were shown to be significant, and the proposed mediators are shown to be valid individually. The next step is to test the full hypothesized mediation model. The aim here is to assess the direct and indirect effects of securitization on the bank profitability in a more dynamic way similar to that in reality, in other words, incorporating all the four proposed mediators at the same time into the model. **Table 4** provides the results of running a SEM analysis of Eq. (6) as specified by the empirical model.

The results from **Table 4** show that the model seems to fit data reasonably well where Chi-square (χ^2) equals 0.400 (χ^2/df = 0.200, p = 0.819), the AGFI equals 1.00, and the RMSEA equals 0.000 (Bentler and Bonett, 1980). The analysis shows that only two out of nine paths are not significant at $p < 0.05$ level or better (the direct path and the path from securitization to liquidity that are significant only at $p < 0.10$).

Table 4: Results of Analysing the Simultaneous Impact of the Transmission Channels

This table provides the results of simultaneously analysing the four transmission channels that mediate the relationship between securitization and bank profitability. We use SEM based on Maximum Likelihood estimation method to estimate the mediation model specified in Eq. (6) as: $\eta = \Gamma \xi + B \eta + \Psi$. Bank Profitability is measured by ROA. Securitization is measured as the ratio of securitization to total assets (SECTASTS). LIQ refers to liquidity ratio and is used as a measure of bank liquidity. RWATA refers to the ratio of risk-weighted assets to total assets and is used as a measure of bank risk. INTTLIB is the ratio of interest expense to total liabilities and is used as a measure of the cost of funding. TIER1LEV is the tier 1 leverage ratio and is used as a measure of regulatory capital. Detailed description of variables is provided in Table B.1. We report standardized coefficients along with their 95% confidence intervals and *p* values as estimated by a bootstrap procedure based on 2000 iterations. To assess significance, ***: significant at p<0.01, **: significant at p<0.05, *: significant at p<0.10.

Panel A: Paths Coefficients

Path	Standardized Coefficients	Confidence Interval Lower	Upper
SECTASTS → INTTLIB	.088***	.055	.145
SECTASTS → LIQ	-.058*	-.201	-.006
SECTASTS → TIER1LEV	.537***	.382	.777
SECTASTS → RWATA	.292***	.132	.596
INTTLIB → ROA	.050**	.001	.094
LIQ → ROA	-.028**	-.061	-.001
TIER1LEV → ROA	.551***	.468	.634
RWATA → ROA	.015**	.006	.056
SECTASTS → ROA	.022	-.050	.213

Panel B: Division of Effect

Total Effect	.328***	.177	.611
Direct Effect	.022	-.050	.213
Indirect Effect	.306***	.210	.433

Panel C: Model Fit

Chi-square (χ^2)	.400
df (χ^2)	2
Prob. (χ^2)	.819
χ^2 / df	.200
AGFI	1.000
RMSEA	.000
PNFI	.133
R^2 (Bank Profitability)	.337
R^2 (Bank Risk)	.085
R^2 (Regulatory Capital)	.288
R^2 (Cost of funding)	.008
R^2 (Liquidity)	.003
Observations	4842

To avoid repetition, the same analysis of the individual relationships and their agreement with or challenging to previous research that is provided above for the individual models applies here as well. However, the complete model is not a mere summation of the individual models as there are few changes in the relationships comprised in this model. While all the paths still have the same direction of the relationship, not all of them have the same degree of significance. Specifically, the path between bank risk and profitability and the path between liquidity and profitability are now significant at $p < 0.05$ level of significance instead of $p < 0.01$ level in their respective individual models. Additionally, the path from securitization to liquidity is significant only at $p < 0.10$ level instead $p < 0.05$ in its individual model. However, this impairment of significance level does not affect the mediation analysis as the liquidity individual mediation model indicates that it mediates only 2% of the total effect. Moreover, the main hypothesis being tested in the complete model is that bank risk, cost of funding, liquidity and regulatory capital jointly mediate the relationship between securitization and bank profitability.

Regarding the simultaneous effects of the proposed transmission channels, the analysis shows that while the indirect effect is significant ($p < 0.01$), the direct effect is not significant ($p > 0.10$). Based on the criteria of Zhao et al. (2010), the results provide evidence of complete mediation and the absence of any significant direct effect. In other words, most the effects that securitization has on bank profitability is transferred through bank risk, cost of funding, liquidity and regulatory capital. The mediation percentage is estimated to be 93% (0.306/0.328). Furthermore, the four-mediator model improves on the results from the initial regression model (**Table 2**) as it explains 34% of the variations in the bank profitability as compared with 28% in the initial regression model. Also, it improves on the results from the individual mediation models (**Table 3**) given that 93% of the effects are mediated as compared with 21%, 15%, 2%, and 92% in the same individual models of bank risk, cost of funding, liquidity, and regulatory capital, respectively.

5.4 Robustness Tests

In this subsection, we present the results of different tests to check the robustness of the main results presented above.

Table 5: Results of Analysing the Mediation Model without Direct Effect

This table provides the results of a robustness check in which we simultaneously analyze the four transmission channels that mediate the relationship between securitization and bank profitability after removing direct effect of securitization. We use SEM based on Maximum Likelihood estimation method to estimate the mediation model specified in Eq. (6) as: $\eta = \Gamma \xi + B \eta + \Psi$. Bank Profitability is measured by ROA. Securitization is measured as the ratio of securitization to total assets (SECTASTS). LIQ refers to liquidity ratio and is used as a measure of bank liquidity. RWATA refers to the ratio of risk-weighted assets to total assets and is used as a measure of bank risk. INTTLIB is the ratio of interest expense to total liabilities and is used as a measure of the cost of funding. TIER1LEV is the tier 1 leverage ratio and is used as a measure of regulatory capital. Detailed description of variables is provided in Table B.1. We report standardized coefficients along with their 95% confidence intervals and *p* values as estimated by a bootstrap procedure based on 2000 iterations. To assess significance, ***: significant at p<0.01, **: significant at p<0.05, *: significant at p<0.10.

Panel A: Paths Coefficients

Path	Standardized Coefficients	Confidence Interval Lower	Upper
SECTASTS → INTTLIB	.088***	.055	.145
SECTASTS → LIQ	-.058*	-.201	.006
SECTASTS → TIER1LEV	.537***	.382	.777
SECTASTS → RWATA	.292***	.132	.596
INTTLIB → ROA	.051**	.001	.097
LIQ → ROA	-.028**	-.060	-.003
TIER1LEV → ROA	.562***	.473	.656
RWATA → ROA	.016**	.002	.042

Panel B: Division of Effect

Total Effect	.313***	.203	.519
Direct Effect	0	…	…
Indirect Effect	.313***	.203	.519

Panel C: Model Fit

Chi-square (χ^2)	2.963
df (χ^2)	3
Prob. (χ^2)	.397
χ^2 / df	.988
AGFI	.999
RMSEA	.000
CFI	1.00
PNFI	.200
R^2 (Bank Profitability)	.336
R^2 (Bank Risk)	.085
R^2 (Regulatory Capital)	.288
R^2 (Cost of funding)	.008
R^2 (Liquidity)	.003
Observations	4842

5.4.1 Full Mediation Model

We estimate the theoretical mediation model again after eliminating the direct effect of securitization. In other words, testing a fully mediated model in which securitization affects profitability only through mediators and comparing it with the original model. As shown in **Table 5**, the fully mediated model fits the data appropriately. The Chi-square (χ^2) equals 2.963 (χ^2/df = 0.988, p = 0.397). The χ^2 difference test between the two models indicates no significant difference (χ^2 difference = 2.523, df = 1, p > 0.10). To compare the two models, the criteria suggested by (Bentler, 1990) are followed. They include four indices: overall model fit as measured by Comparative Fit Index (CFI), amounts of variance explained by R^2, percentage of the proposed significance paths, and Parsimonious Normed Fit Index (PNFI).

The comparison shows that both models are equivalent on the overall statistics fit CFI (1.00). Only two out of the nine original model paths are significant at p < 0.05 level or better. On the other hand, seven out of eight of the fully mediated model's paths were significant at the same level. In relation to the ability of the models to explain variance in the outcomes, as measured by R^2, the two models are equivalent in explaining nearly 34% of the variation in bank profitability. Finally, the fully mediated model has a higher PNFI value than the original model (0.20 and 0.133 respectively). To sum up, some minor differences exist between the two models for some criteria, but both models seem to equivalently and comparably explain the mediation model of the securitization-profitability relationship. However, the original mediation model still outperforms the fully mediated model. The reason is that the original model has a direct effect path that accounts not only for the true direct effect from securitization to profitability, but also for any probably omitted mediator.

5.4.2 Adding Control Variables

Furthermore, another test for the robustness of the results obtained using the original empirical model is to insert some control variables into the model and monitoring the change in the securitization-bank profitability relationship. Control variables are defined in **Table B.1**. The results of re-estimating the mediation model after including the control variables are presented in **Table 6**. Based on these results, we can conclude some interesting findings. First, due to the inclusion of additional control variables the R^2 of the new model is higher (0.394 compared to 0.337 in the original model). Second, compared with the baseline specification, this specification

does not seem to fit the data well ($\chi^2 = 396.595$, $\chi^2/df = 5.75$, $p = 0.085$), in addition, five out of seventeen paths are not significant at $p < 0.05$ or better. Third, the direct effect is not significant while the indirect effect is significant at $p < 0.05$. This replicates the results obtained from the original model and supports the conclusion of full mediation. Fourth, the proportion of the indirect effect to the total effect increased to nearly 99.7% compared to 93% in the original model. However, this is due to the distortion in the total and direct effects (0.315 and 0.001 compared to 0.328 and 0.022 in the original model respectively) realized by the current model from securitization to bank profitability through different paths.

All in all, the findings from inserting control variables into the mediation model indicate that the original model explains the securitization-bank profitability meditational relationship more accurately. In other words, there is no need to include control variables in the original model.

5.4.3 Using Alternative Measures

Another robustness check is to repeat the analysis using alternative measures of securitization, bank profitability and mediators. The overall purpose is to ensure that the main findings obtained and presented above are not specific to the way by which these measures were computed. Five different models are estimated based on the same methodology outlined by the empirical model. The results of these new models are presented in **Table 7**. For simplicity, we refer to each model based on the number at the top of its column. To assess the consistency in the profitability measures, model (1) substitutes the ROA measure in the original model with the NIM. Similarly, to assess the consistency in the measures of mediators, model (2) adds to model (1) by using different measures for all the mediators. Specifically, model (2) uses interest to deposits ratio (INTTDEP) to measure the cost of funding, Tier 1 risk based capital (TIER1RBC) to measure regulatory capital, charge offs ratio (CHRGOFS) to measure bank risk, and cash assets to total assets ratio (CORELIQ) to measure liquidity. Furthermore, to assess the consistency in the securitization measures, model (3) substitutes the securitization measure in model (2) with the ratio of outstanding securitization to total loans (SECTLNS). Additionally, model (4) substitutes the measures of mediators used in the original model with those used in model (2). Finally, model (5) replicates model (4), except for using SECTLNS as a measure for securitization.

The results shown in **Table 7** indicate that all the models provided fit the data reasonably well. While models (2), (4) and (5) have eight significant paths out of nine; model (1) has only seven, and model (3) has all its nine paths significant. While the results of models (1), (2) and (5)

Table 6: Results of Analysing the Mediation Model with Control Variables

This table provides the results of a robustness check in which we simultaneously analyze the four transmission channels that mediate the relationship between securitization and bank profitability while including control variables. We use SEM based on Maximum Likelihood estimation method to estimate the mediation model specified in Eq. (6) as: $\eta = \Gamma \xi + B \eta + \Psi$. Bank Profitability is measured by ROA. Securitization is measured as the ratio of securitization to total assets (SECTASTS). LIQ refers to liquidity ratio and is used as a measure of bank liquidity. RWATA refers to the ratio of risk-weighted assets to total assets and is used as a measure of bank risk. INTTLIB is the ratio of interest expense to total liabilities and is used as a measure of the cost of funding. TIER1LEV is the tier 1 leverage ratio and is used as a measure of regulatory capital. Control variables include capital ratio (CAP), size (SIZE), trading assets to total assets (TRDASTS), loans to assets ratio (LNSTASTS), loans to deposits ratio (LNSTDEP), market share (MRKTSH), deposits to assets ratio (DEPTASTS), and real GDP growth (GDPG). Detailed description of variables is provided in Table B.1. We report standardized coefficients along with their 95% confidence intervals and *p* values as estimated by a bootstrap procedure based on 2000 iterations. To assess significance, ***: significant at p<0.01, **: significant at p<0.05, *: significant at p<0.10.

Panel A: Paths Coefficients			
Path	Standardized Coefficients	Confidence Interval Lower	Upper
SECTASTS → INTTLIB	.089**	.055	.120
SECTASTS → LIQ	-.058*	-.140	.004
SECTASTS → TIER1LEV	.539**	.486	.646
SECTASTS → RWATA	.294**	.184	.453
RWATA → ROA	.015**	-.058	.084
LIQ → ROA	-.134***	-.234	-.029
SECTASTS → ROA	.001	-.067	.149
TIER1LEV → ROA	.551***	.375	.675
INTTLIB → ROA	.055**	.011	.106
CAP → ROA	-.019	-.149	.177
GDPG → ROA	.050**	.028	.078
SIZE → ROA	.082*	.046	.123
TRDASTS → ROA	-.086**	-.164	-.018
LNSTASTS → ROA	-.131**	-.228	-.013
LNSTDEP → ROA	.027**	.007	.045
MRKTSH → ROA	.014	-.024	.058
DEPTASTS→ ROA	.010	-.036	.047
Panel B: Division of Effect			
Total Effect	.315**	.208	.493
Direct Effect	.001	-.067	.149
Indirect Effect	.314**	.211	.388
Panel C: Model Fit			
Chi-square (χ^2)	396.595		
df (χ^2)	69		
Prob. (χ^2)	.085		
χ^2 / df	5.75		
AGFI	.501		
RMSEA	.286		
R^2 (Bank Profitability)	.394		
R^2 (Bank Risk)	.086		
R^2 (Regulatory Capital)	.291		
R^2 (Cost of funding)	.008		
R^2 (Liquidity)	.003		
Observations	4842		

Table 7: Results of Analysing the Mediation Model Using Alternative Variable Measures

This table provides the results of a robustness check in which we simultaneously analyze the four transmission channels that mediate the relationship between securitization and bank profitability while using different variable measures compared to the initial specification. We use SEM based on Maximum Likelihood estimation method to estimate the mediation model specified in Eq. (6) as: $\eta = \Gamma \xi + B \eta + \Psi$. Bank Profitability is measured by ROA, or NIM. Securitization is measured as the ratio of securitization to total assets (SECTASTS) or to total loans (SECTLNS). Liquidity is measured by core liquidity (CORELIQ) or liquidity ratio (LIQ). Bank risk is measured by risk-weighted assets to total assets (RWATA), or charge-offs ratio (CHRGOFS). Cost of funding is measured by interest to liabilities (INTTLIB) or interest to deposits (INTTDEP). Regulatory capital is measured by tier 1 leverage ratio (TIER1LEV), or tier 1 risk based capital ratio (TIER1RBC). Detailed description of variables is provided in Table B.1. We report standardized coefficients along with their 95% confidence intervals and *p* values as estimated by a bootstrap procedure based on 2000 iterations. To assess significance, ***: significant at p<0.01, **: significant at p<0.05, *: significant at p<0.10.

	(1)	(2)	(3)	(4)	(5)
Panel A: Paths Coefficients					
SECTASTS → NIM	.003	.007			
SECTASTS → TIER1LEV	.539**				
SECTASTS → INTTLIB	.089**				
SECTASTS → RWATA	.294**				
SECTASTS → LIQ	-.058				
INTTLIB → NIM	.374***				
TIER1LEV → NIM	.146***				
RWATA → NIM	.150**				
LIQ → NIM	-.008				
SECTASTS → TIER1RBC		.464***		.464***	
SECTASTS → INTTDEP		-.006**		-.006**	
SECTASTS → CHRGOFS		.282**		.282**	
SECTASTS → CORELIQ		.057**		.057**	
INTTDEP → NIM		.107***	.106***		
TIER1RBC → NIM		.047*	.077***		
CHRGOFS → NIM		.472**	.482**		
CORELIQ → NIM		-.044**	-.049**		
SECTLNS → NIM			-.071**		
SECTLNS → TIER1RBC			.397***		.397***
SECTLNS → INTTDEP			-.004**		-.004**
SECTLNS → CHRGOFS			.154**		.154**
SECTLNS → CORELIQ			.028*		.028*
INTTDEP → ROA				.037**	.032**
TIER1RBC → ROA				.284**	.371***
CHRGOFS → ROA				.092	.137**
CORELIQ → ROA				-.168***	-.180***
SECTASTS → ROA				.182**	
SECTLNS → ROA					-.016
Panel B: Division of Effect					
Total Effect	.159**	.159**	.033	.330**	.147**
Direct Effect	.003	.007	-.071**	.182**	-.016
Indirect Effect	.156**	.152**	.103**	.148***	.163***
Panel C: Model Fit					
Chi-square (χ^2)	.045	.867	1.019	.903	.976
df (χ^2)	2	2	2	2	2
Prob. (χ^2)	.978	.648	.601	.637	.614
χ^2 / df	.023	.434	.509	.452	.488
AGFI	1.000	.999	999	.999	.999
RMSEA	.000	.000	.000	.000	.000
R^2 (Bank Profitability)	.236	.248	.252	.191	.168
R^2 (Bank Risk)	.086	.080	.024	.080	.024
R^2 (Cost of funding)	.008	.000	.000	.000	.000
R^2 (Liquidity)	.003	.003	.001	.003	.001
R^2 (Regulatory Capital)	.291	.216	.158	.216	.158
Observations	4842	4842	4842	4842	4842

support the existence of full mediation indicated by a significant indirect effect and an insignificant direct effect, model (4) shows a case of partial mediation with both direct and indirect effects being significant. Model (3) provides and interesting case in which the total effect is not significant, while both direct and indirect effects are significant. Following the criteria of Zhao et al. (2010), this is a case of competitive mediation in which the direct and indirect effects are significant, but have opposing signs. In sum, it can be concluded that the evidence provided about the mediation effects in the securitization-bank profitability relationship is robust and can be replicated using different measures of securitization, mediators or bank profitability.

5.5 Discussion

Overall, the results presented here provide a better understanding of the channels through which securitization affects bank profitability. The explicit and simultaneous consideration of these transmission channels provides additional explanatory power regarding how securitization affects bank profitability. In addition, identifying these channels is important as it helps design better securitization transactions. Therefore, our findings provide some useful insights for banks. For example, the ability to divide the effects of securitization between different components of the securitization-profitability relationship enables the bank to control this relationship. In other words, the bank can alter its decisions regarding which loans to securitize, what type of enhancements and recourse to provide, and the timing of transactions. These decisions together would improve the design of securitization transactions and help banks to use securitization activities to boost their profitability while limiting the adverse effects on their soundness.

On the regulation front, although literature has shown that securitization provides profitability benefits, some argue that regulatory initiatives towards supporting the housing market has influenced risk taking behaviour by banks that were active in securitization markets in the run up to the global financial crisis (Mian and Sufi, 2009). Along the same lines, our analysis shows that profitability gains might come at the expense of some adverse effects on bank risk. For example, we show that securitization is associated with higher bank risk and cost of funding which might have negative consequences for the bank stability. Therefore, our findings may support the current regulatory initiatives to address these flaws in the securitization market in a post financial

crisis world. One such initiative is the ECB's framework for simple, transparent, and standardized (STS) securitization (Mersch, 2017). This framework aims at reducing information asymmetries between the counterparties by improving securitizations structure and transparency on underlying assets. It also aims at promoting responsible securitisation through measures that align interest between issuer banks and investors. In addition, it requires banks to provide loan-level information for ABSs if used as collateral in the Eurosystem's credit operations (ECB and BoE, 2014).

6 Conclusion

This paper contributes to the literature by exploring in depth the channels through which securitization impacts bank profitability. We simultaneously assess the mediating role of bank risk, cost of funding, liquidity and regulatory capital in this relationship. To this end, we use a mediation model to thoroughly investigate how securitization affects bank profitability. Also, we use a novel empirical framework based on structural equations modeling that simultaneously test the different relationships comprised in the proposed mediation model. The model also contributes to the existing literature on bank profitability by breaking down the securitization effects on profitability into direct and indirect effects.

We show that securitization is likely to improve bank profitability. Moreover, the proposed mediation model provides an accurate and thorough representation of the relationship between securitization and bank profitability. The results show that bank risk, cost of funding, liquidity and regulatory capital individually and jointly mediate the securitization-profitability relationship. The explicit consideration of these transmission channels together provides additional explanatory power regarding how securitization affects bank profitability.

Our findings have implications for banks, financial markets and regulators. At the bank level, the ability to divide the effects of securitization between different components of the securitization-profitability relationship enables the bank to control this relationship. In other words, the bank can alter its decisions regarding which loans to securitize, what type of enhancements and recourse to provide, and the timing of transactions. These decisions together would improve the design of securitization transactions. Additionally, the financial market would improve its assessment of the perceived risk increase or decrease of a bank due to a securitization

transaction. The investors would then be able to adjust their required rate of return on the bank equity capital based on the new risk expectations, which implies a fair share price. Finally, regulators would be able to impose regulations that ensure a fair and transparent securitization market.

There are some opportunities to extend the current analysis in different dimensions. The analysis could be enhanced by integrating additional variables that account for other performance indicators to construct a comprehensive bank performance mediation analysis. Additionally, further analysis can be done to investigate the impact of different types of securitization, including ABS or MBS, on bank profitability. Moreover, it might be useful to incorporate sub-samples for the periods before and after the 2008 credit crisis. This would provide insightful evidence about the moderating role of the financial crisis on the securitization-profitability relationship.

Appendix A: Mediation Analysis using Structural Equations Modelling (SEM)

This appendix provides an overview of using Structural Equations Modelling (SEM) to specify a mediation model. Let *y, m,* and *x* be the dependent, mediator, and exogenous variables, respectively. A mediation model can then be described by the following system of equations:

$$y = \beta_{ym}\, m + \varepsilon_y \tag{A.1}$$

$$m = \gamma_{mx}\, x + \varepsilon_m \tag{A.2}$$

In a SEM notation, this system of equations can be rewritten as:

$$Y = \Gamma\, X + B\, Y + \Psi \tag{A.3}$$

where Y is a 2 x 1 vector that represents the endogenous variables: the mediator used and the bank profitability. X is a 1 x 1 vector representing the exogenous variable: securitization, while Γ is a 2 x 1 vector representing the relation between securitization as an independent variable and each one of the mediator and bank profitability as dependent variables. Moreover, B is a 2 x 2 matrix that represents the relation between the mediator and bank profitability. Finally, Ψ is a 2 x 1 vector that represents the error terms of the endogenous variables. Eq. (A.3) can also be rewritten as follows:

$$\begin{bmatrix} \mathrm{m} \\ \mathrm{y} \end{bmatrix} = \begin{bmatrix} \gamma_{\mathrm{mx}} \\ \gamma_{\mathrm{yx}} \end{bmatrix} [\mathrm{X}] + \begin{bmatrix} \beta_{\mathrm{mm}} = 0 & \beta_{\mathrm{my}} = 0 \\ \beta_{\mathrm{ym}} & \beta_{\mathrm{yy}} = 0 \end{bmatrix} \begin{bmatrix} \mathrm{m} \\ \mathrm{y} \end{bmatrix} + \begin{bmatrix} \Psi_{\mathrm{m}} \\ \Psi_{\mathrm{y}} \end{bmatrix} \tag{A.4}$$

This logic can be generalized for any number of mediators N. Let *y, m_1, m_2, …, m_N,* and *x* be the dependent, N mediators, and exogenous variables, respectively. Following the same logic used to arrive at Eq. (A.3), the N-mediator model can be expressed by the following equation:

$$\eta = \Gamma\, \xi + B\, \eta + \Psi \tag{A.5}$$

where η is a (N+1) x 1 vector that represents the endogenous variables: The N mediators used and the bank profitability. Also, ξ is a 1 x 1 vector representing the only exogenous variable used: securitization, while Γ is a (N+1) x 1 vector representing the relation between securitization as an independent variable and each one of the mediators and bank profitability as dependent variables. Moreover, B is a (N+1) x (N+1) matrix that represents the relation between mediators and bank profitability. Finally, Ψ is a (N+1) x 1 vector that represents the error terms of the endogenous variables. Eq. (A.5) can then be rewritten as follows:

$$\begin{bmatrix} m_1 \\ m_2 \\ \dots \\ m_N \\ \mathrm{y} \end{bmatrix} = \begin{bmatrix} \gamma_{m_1 \mathrm{x}} \\ \gamma_{m_2 \mathrm{x}} \\ \dots \\ \gamma_{m_N \mathrm{x}} \\ \gamma_{\mathrm{yx}} \end{bmatrix} [\mathrm{X}] + \begin{bmatrix} 0 & 0 & \dots & 0 & 0 \\ 0 & 0 & \dots & 0 & 0 \\ \dots & \dots & \dots & \dots & \dots \\ 0 & 0 & \dots & 0 & 0 \\ \beta_{\mathrm{y}m_1} & \beta_{\mathrm{y}m_2} & \dots & \beta_{\mathrm{y}m_N} & 0 \end{bmatrix} \begin{bmatrix} m_1 \\ m_2 \\ \dots \\ m_N \\ \mathrm{y} \end{bmatrix} + \begin{bmatrix} \Psi_{m_1} \\ \Psi_{m_2} \\ \dots \\ \Psi_{m_N} \\ \Psi_{\mathrm{y}} \end{bmatrix} \tag{A.6}$$

Matrix B and vectors Γ and Ψ can be estimated using Maximum Likelihood, and the coefficients estimates can be used to calculate direct and indirect effects.

Appendix B: Variables Definitions

Table B.1: Variables Definition

All variables are adopted from the FFIEC Reports of Condition and Income (Call Reports), except for GDPG that is obtained from the FRED database from Federal Reserve Bank of St. Louis. All variables are represented in decimals, except SIZE which is estimated as the log of total assets. The sign column shows the expected direction of the impact of explanatory on the dependent variable where DV indicates the dependent variable, + indicates expected positive impact, - indicates expected negative impact, and +/- indicates inconclusive impact.

Acronym	Variable	Construction	Sign
Panel A: Bank Profitability			
ROA	Return on assets	The ratio of net income to total assets	DV
NIM	Net Interest margin	The ratio of net interest income to total assets	DV
Panel B: Cost of funding			
INTTLIB	Interest expense to total liabilities	The ratio of interest expense to total liabilities	-
INTTDEP	Interest expense to total deposits	The ratio of interest expense to total deposits	-
Panel C: Regulatory Capital			
TIER1LEV	Tier1 leverage ratio	Tier1 leverage ratio	+
TIER1RBC	Tier1 risk based capital ratio	Tier1 risk based capital ratio	+
Panel D: Bank Risk			
RWATA	risk weighted assets to total assets	The ratio of risk weighted assets to total assets	-
CHRGOFS	Charge-offs ratio	The ratio of net charge offs to total loans	-
Panel E: Liquidity			
CORELIQ	Core Liquidity ratio	The ratio of cash assets to total assets	+/-
LIQ	Liquidity ratio	The ratio of cash and securities to total loans	+/-
Panel F: Securitization Activities			
SECTASTS	Securitization to total assets	The ratio of all outstanding securitizations to total assets	+
SECTLNS	Securitization to total loans	The ratio of all outstanding securitizations to total loans	+
Panel G: Control Variables			
SIZE	Size	The natural logarithm of total assets	+/-
TRDASTS	Trading assets to total assets	The ratio of trading assets to total assets	+/-
LNSTASTS	Loans to total assets	The ratio of loans to total assets	+/-
LNSTDEP	Loans to deposits	The ratio of loans to deposits	+/-
DEPTASTS	Deposits to total assets	The ratio of deposits total assets	+/-
CAP	Capital ratio	The ratio of equity capital to total assets	+/-
MRKTSH	Market share	The ratio of bank's total assets to the sum of all banks assets	+/-
GDPG	GDP real growth	The real growth in GDP published quarterly	+/-

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